FAA Satellite Navigation Programs (WAAS/LAAS Update)

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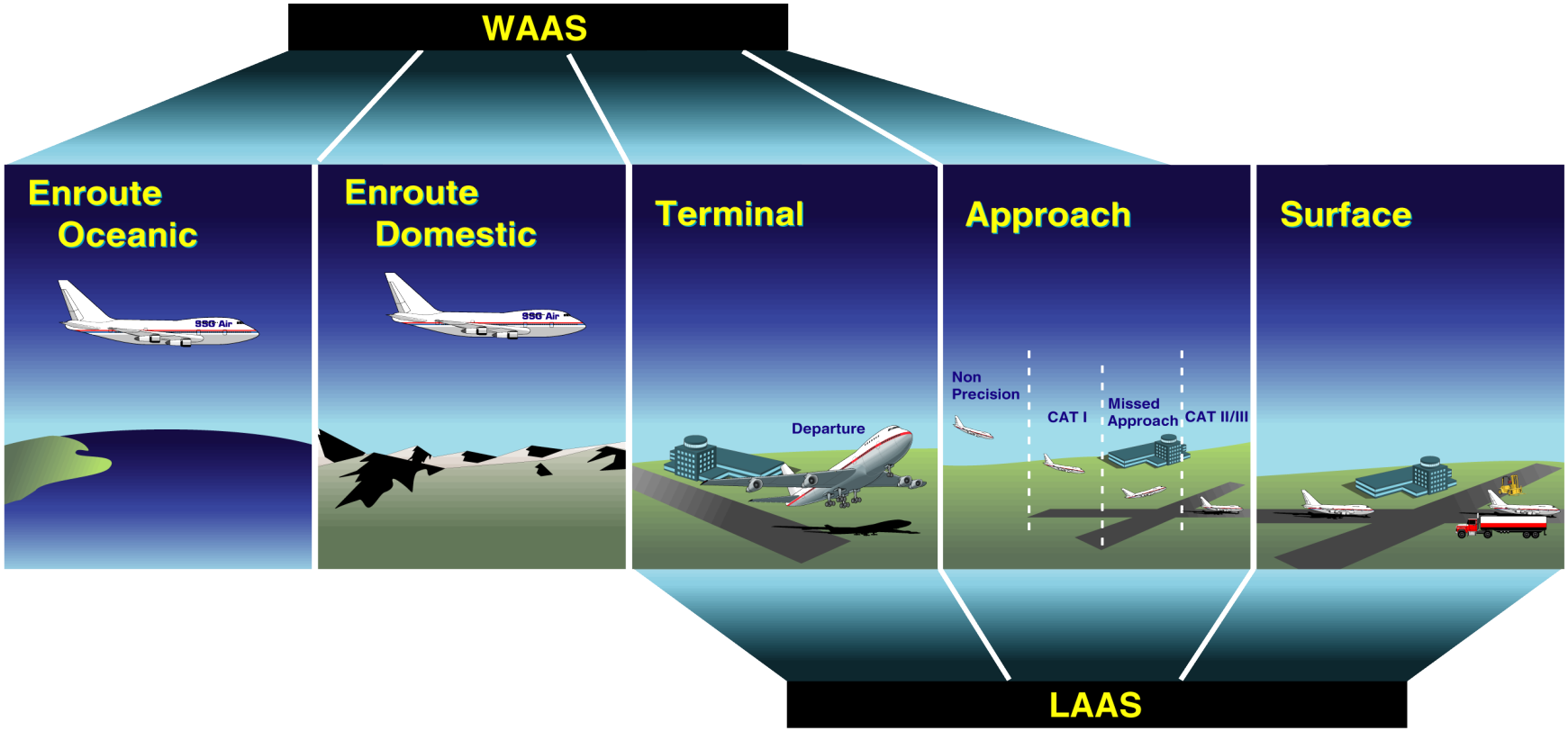
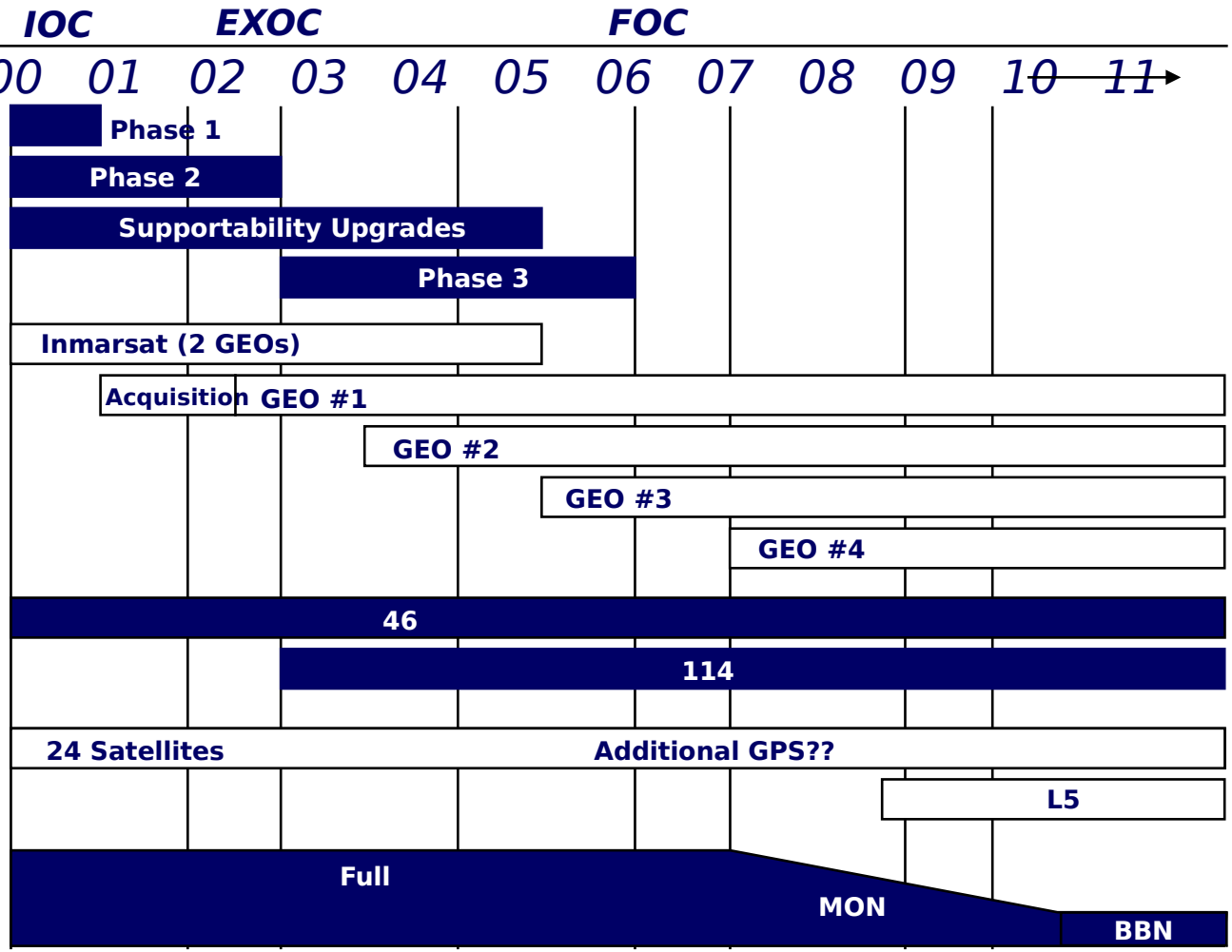
Satellite Navigation
WAAS / LAAS Implementation



Satellite Navigation Implementation Schedule*

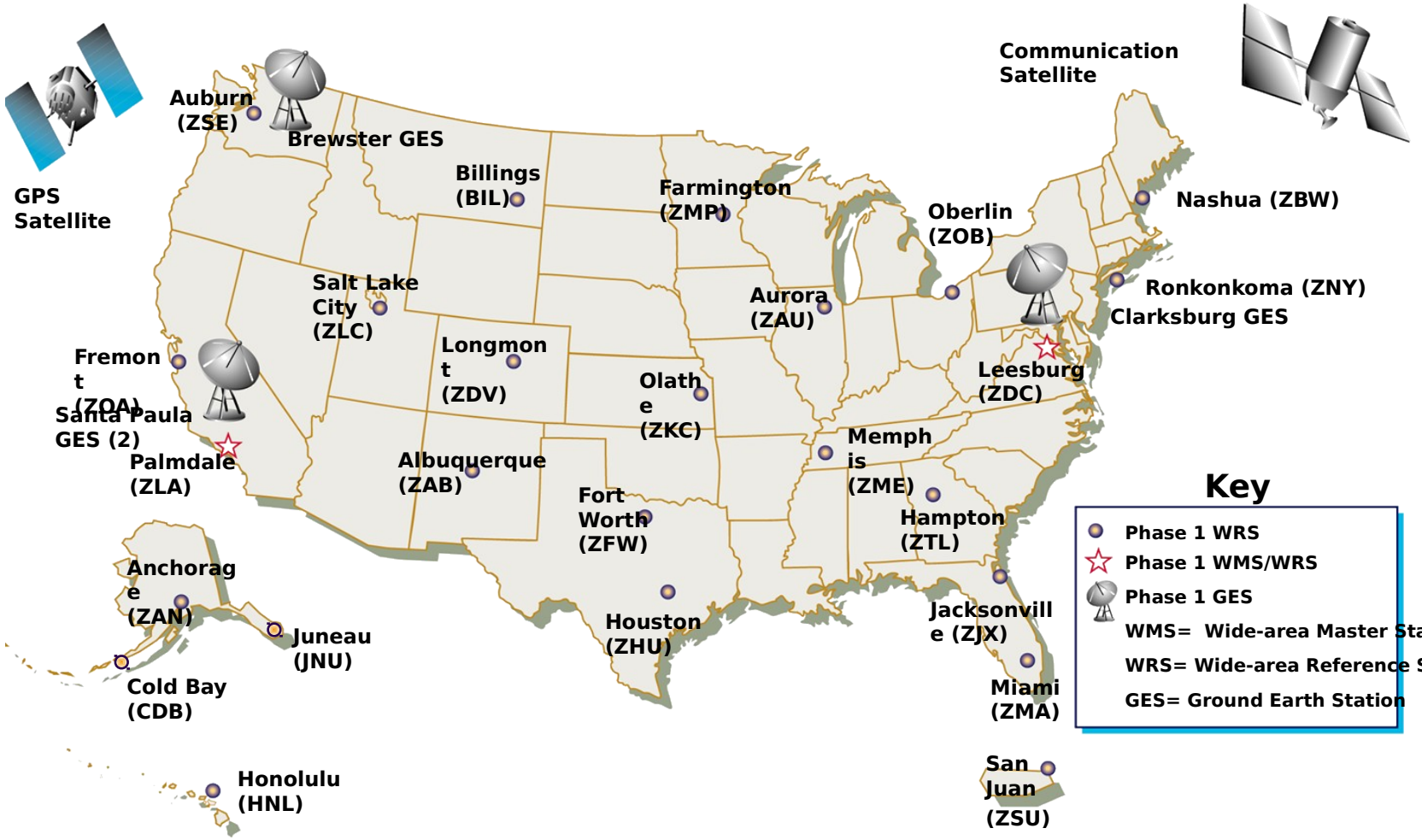


* SOURCE: FAA SatNav Investment Analysis, September 1999

WAAS Phase 1 Accomplishments

- **Nationwide Network of Diverse Components Has Been Successfully Integrated**
  - **Data Collection Processing (25 Ground Stations)**
  - **Master Stations (2 Ground Stations)**
  - **GEO Uplink Stations (4 Ground Stations)**
  - **GEOs (2 Satellites)**
  - **Nationwide Telecommunications System**
- **Three Major System Builds Confirmed Validity of WAAS Design (April-August 1999)**
  - **System Stability**
  - **Full System Functionality**
  - **System Performance**

Wide Area Augmentation System
Phase 1 Equipment Locations



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WAAS Problem Areas

- **Two Problems Have Been Identified**
  - **Stability**
  - **Integrity**

- **Problems Preclude FAA Commissioning of Any Level of Service in FY00**

WAAS Stability Issue

- **Commenced 60-day Stability Test on Dec 13, 1999**
  - **Accuracy Required: 7.6 Meters**
  - **Accuracy Demonstrated: 2-3 Meters**
- **Test Halted After 30 Days Due To 100 Minute Signal Loss**
  - **Problems with Backup Geostationary Uplink Station (GUS) Transition Function**
  - **Software Problem in C&V Processor**
  - **Excessive Alarms**
- **Raytheon Working Corrections**
  - **Fixes for 4 of 7 Problems Have Been Identified**
  - **Fixes for Remaining 3 Problems Will Be Tested April/May 2000**

WAAS System Integrity

- **Problem Identified Meeting This Requirement**
  - **Analysis Indicates Integrity Monitors Do Not Work Correctly**
  - **HMI Event in Dec 99 - Monitor Did Not Detect**
- **Meeting FAA Safety Integrity Requirement is Most Significant Schedule Driver**
  - **No Greater Than One in 10 Million Chance of Failure for a Given Approach (Hazardously Misleading Information - HMI)**

WAAS System Integrity (cont)

- **WAAS Integrity Performance Panel (WIPP)**
  - **FAA Established Team of Experts in January 2000 To Work Closely With Raytheon to Identify Most Cost-Effective and Expedient Solution**
  - **Team Includes FAA, MITRE, Stanford University, Ohio University, JPL**
  - **Will Provide Technical Strategy for the Foreseeable Future**
- **Recent WIPP Activities**
  - **Identified Solution for Enroute & Non-Precision Integrity**
  - **Identified a Path to Achieve LNAV/VNAV Integrity**
- **WAAS Phase 1 IOC Projected in CY2002**
- **WIPP Will Identify Solution and Migration Path to GLS Within 9 Months**
  - **Results Used to Refine Detailed Cost & Schedule for Future Program**

LAAS Status

Apr 99 Two Government-Industry Partnerships (GIP) Formed for LAAS CAT I Development (Honeywell and Raytheon)

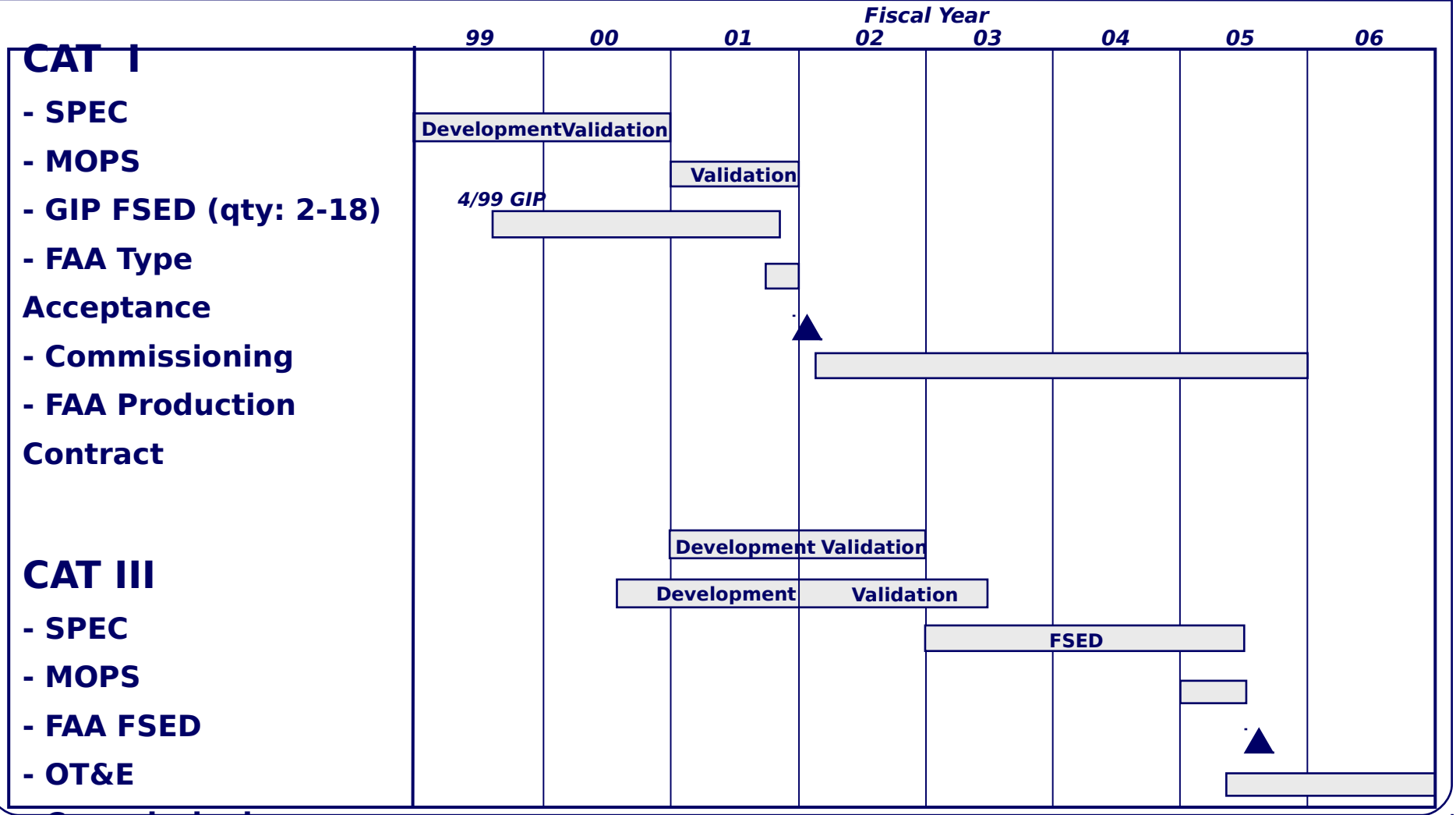
Sep 99 LAAS Spec (CAT I) Completed and Approved

Fall 99 Conducted 2 Wide Body A/C Flight Tests

- UPS (Boeing 767) at Atlantic City--35 of 35 Successful Flight Trials
- FedEx (MD-10) at Memphis--39 of 39 Successful Flight Trials
- Verified Reception of a Pseudolite Signal by Wide Body A/C and Ability to Accurately Range from Signal (CAT III LAAS)

Feb 00 RTCA DO-253, LAAS MOPS Approved

LAAS Program Schedule



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